Mitt. Münch. Ent. Ges.	88	19-24	München, 01.11.1998	ISSN 0340-4943

Description of the larva of *Trichognathus marginipennis* LATREILLE, 1829

(Coleoptera, Carabidae)

Erik ARNDT and Ulf DRECHSEL

Abstract

The third instar larva of the monotypic Neotropical genus *Trichognathus* LATREILLE (Galeritini) is described and compared with the larvae of *Galerita* FABRICIUS. Both genera are characterized by a protruding, horn-like nasale, extremely long, flagelliform setae on antennomeres III and IV, long legs with slender leg segments, whip-shaped urogomphi, and a similar, peculiar chaetotaxy. The larva of *Trichognathus* is distinguished from that of *Galerita* by the parallel sides of the head capsule with abruptly constricted neck, the shorter nasale horn, stouter galea, longer maxillary palpus, short and indistinct ligula, simple claws without bristles or appendages, and the simple anterior coxa. A sistergroup relationship between Galeritini and Dryptini is proposed. The long antenna with flagelliform setae on the last antennomeres, the constricted neck, the long coronal suture and the shape of the urogomphi are regarded as larval synapomorphies of Galeritini and Dryptini.

Introduction

The monotypic genus *Trichognathus* LATREILLE is a representative of the tribe Galeritini (BALL 1985, REICHARDT 1967), an advanced stock of the Harpalinae (ARNDT 1993, ERWIN 1991). The Galeritini are distributed with five genera in North America (USA, South-Eastern part of Canada), Central America, and the tropical regions of South America, Africa and South East Asia. *Trichognathus* was regarded as one of the basal genera of the Galeritini by REICHARDT (1967) but as most derived genus and sistergroup of *Galerita* FABRICIUS by BALL (1985).

Ecology and natural history of the Galeritini are little known. Adults and larvae seem to be fast-moving hunters. Although their food is unknown, detailed study of the mouthparts of adults (BALL 1985) suggests that food capture and manipulation may have played an important role in the evolution of genera.
An interesting behavior was described for *Galerita corumbana* LIEBKE (REICHARDT 1971). This species shows a bombarding behavior, similar to that of brachinines. Unconfirmed reports about bombarding behavior do also exist for *Galerita janus* (FABRICIUS) (REICHARDT 1967). However, details of the biochemistry and gland structure of these species are unknown.

Little is known about larvae of the Galeritini. Short or incomplete larval descriptions of single species of *Galerita* are given by SALLÉ (1849, *G. lecontei* DEJEAN), CANDÈZE (1861, *G. nigra* CHEVROLAT, *G. simplex* CHAUDOIR), SCHAUPP (1882, *G. janus*), and KIRK (1980, *G. janus*). The last instar larvae of *Galerita brasiliensis* DEJEAN and *G. carbonaria* MANNERHEIM were described in detail by COSTA et al. (1988). Short larval characterizations of the tribe Galeritini were presented by VAN EMDEN (1942, based on two *Galerita* species and undetermined larval specimens) and THOMPSON (1979, based on *G. lecontei* and *G. bicolor* (DRURY)). Larvae from other genera than *Galerita* are unknown. A more detailed knowledge of larvae would help us to understand the ecology and phylogeny of the galeritine genera.

It is the aim of the present paper to describe the third instar larva of *Trichognathus marginipennis* LATREILLE and to compare the larval characters of *Trichognathus* with those of *Galerita*.

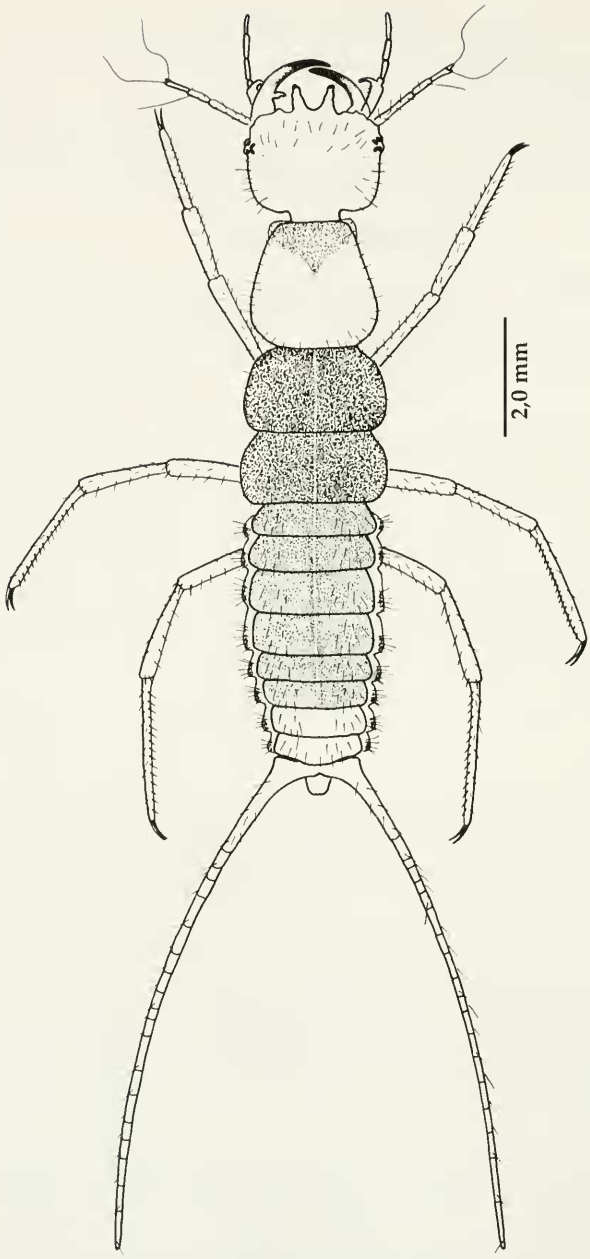
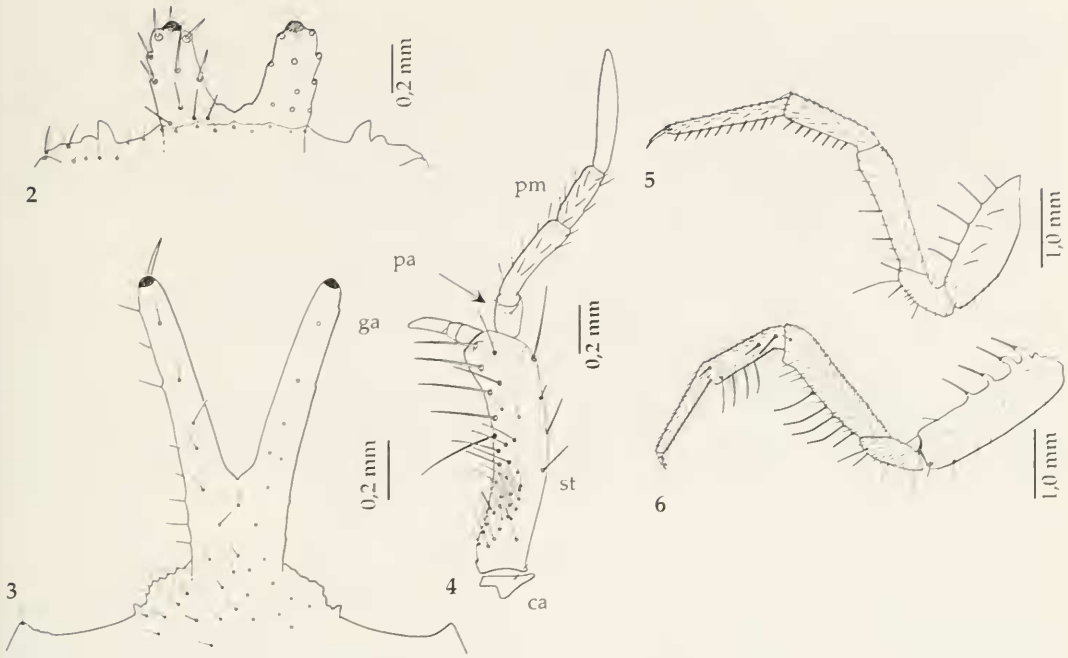


Fig. 1: Habitus. Third instar, *Trichognathus marginipennis*.

Material and methods

The description is based on the following larval material: *Trichognathus marginipennis*, Paraguay, Dept. Cordillera, Altos, 380 m; April 1992 (2 specimens) and November 1996 (1 specimen), leg. Drechsel together with numerous adults (det. ex assoc.). For comparative purpose the third instar larvae of *Galerita janus* and *Drypta dentata* Rossi are examined. All larvae are deposited in the personal collection of Arndt.



Figs 2-3: Nasale and adnasale region; third instar. 2. *Trichognathus marginipennis* 3. *Galerita janus*. Scales in mm.
Fig. 4: Maxilla, right side, dorsal view; third instar, *Trichognathus marginipennis* (ca - cardo. ga - galea, pa - palpifer, pm - palpus maxillaris, st - stipes). Scale in mm.
Figs 5-6: Anterior leg, posterolateral view; third instar. 5. *Trichognathus marginipennis* 6. *Galerita janus*. Scales in mm.

The specimens are preserved in 70 % ethanol and were studied using a stereo microscope up to 80×. One specimen of each species was cleared in 10 % KOH for 12 hours, after that transferred into a series of three water baths for two hours each to wash out the potassium hydroxid, and after transfer in an ethanol/xylol series mounted in Canada balsam on a microscope slide. This allows the examination under a phase contrast microscope at a magnification up to 400×. Moreover, the cleared head capsule and pronotum of those specimens permits easier and more detailed study of morphological features.

Terms of morphology and chaetotaxy follow Arndt (1993) and Bousquet & Goulet (1984).

Description of third instar larva

Head width. 2.26-2.29 (average 2.27) mm.

Coloration. Posterior part of prothorax, legs, abdominal tergites IX and X, and urogomphi yellow, the other sclerites dorsally brown; body ventrally whitish.

Microsculpture. Head with isodiametric mesh pattern, prothorax, meso- and metathorax, and abdominal tergites with squamous microsculpture. Pygopod, tergite IX and urogomphi pointed.

Head. Neck constricted, cervical and ocellar grooves absent (Fig. 1), 6 stemmata present, coronal suture very long, about as long as half head width; nasale of two very big and protruding horns (Fig. 2), adnasale region with two big teeth. Head ventrally with several very small setae and three large bristles; gular suture lacking. Mandible slender with retinaculum in basal half, outer margin of mandible with seta MN_1 in the middle and a group of setae basally, penicillus lacking. Antenna very slender with antennomere I longest, antennomere IV shortest, appendage of antennomere III small. Antennomere III with one and antennomere IV with two extremely long and thin, flagelliform setae. Maxilla with triangular cardo, stipes long and slender, 4-5 times longer than wide; palpifer short, shorter than articles of maxillary palpus;

maxillary palpus slender with last palpomere longest and penultimate shortest; lacinia lacking, galea two-articled, short, finger-shaped, galeomere II longer than galeomere I; relation of palpifer and maxillary palpomeres I, II, III 1:2.3:1.7:3.3; setal group gMX with about 30 setae, arranged in two rows, one row mesoventrally, one row mesodorsally, only in basal part of stipes arranged in a single group; setae of gMX group long in anterior part and short in basal part of stipes; several further setae on lateral margin of stipes; palpifer with large seta MX_{10} ventrally and a very small seta dorsally; palpomere I and II multisetose, palpomere III smooth (Fig. 4); prementum very wide, multisetose with ligula very small but present; labial palpomeres long and slender, palpomere I multisetose, palpomere II smooth; hypopharynx distinct, protruded, densely covered with small setae.

Thorax. Prothorax conical, multisetose, longer than wide; meso- and metathorax wider than long with anterior keel present, multisetose. Legs very long, trochanter, femur, tibia and tarsus slender and multisetose, two slender claws without setae or appendages. Dorsal margin of anterior coxa with a row of large bristles (Fig. 3); setae on coxa less dense than on the other leg segments. Median and posterior tarsi longer than anterior tarsus and distinctly longer than tibia and femur.

Abdomen. Abdominal tergites multisetose with anterior keel and median suture present. Sternites indistinct, those of abdominal segments IV-IX fused. Urogomphi fused with abdominal tergite IX, whip-shaped, about as long as metathorax and abdomen together, multisetose and multisegmented, consisting of 18-22 articles, each article with a seta at apex. Pygopod stout, short, conical.

Natural history data

T. marginipennis occurs throughout tropical South America. In Paraguay, the species is restricted to the moist eastern part of the country. There, adults are active from September to May and larvae (last instar) from December to April. Both larvae and adults are nocturnal and inhabit usually moist clay substrate along rivers and small streams in grassland as well as in gallery forests.

T. marginipennis is associated regularly with species of the nocturnal tiger beetle genus *Megacephala*. Adults of both genera show a similar fast-running behaviour.

Discussion

Larvae of *Trichognathus* and *Galerita* are very similar. Both genera are characterized by a divided, horn-like nasale, very long legs with slender leg segments, whip-shaped urogomphi, and even a similar but peculiar chaetotaxy. For example, the extremely long, flagelliform setae on antennomeres III and IV (see also Costa et al. 1988, plate 11, fig. 4) belong to the peculiar chaetotaxy characters. Table 1 shows the different character states of *Trichognathus* and *Galerita*.

Character states of first instar larvae, which are of particular interest regarding phylogenetic discussions, were described by Thompson (1979) for the genus *Galerita*. The primary larva of *Galerita* has four-articled urogomphi with one seta on each of the basal three articles and two setae on apex of the ultimate article as also known for genus *Cymindis* Latreille (Arndt 1991) and other lebiine genera.

The Galeritini show markedly derived character states in larval stage compared with most other carabids. They share the long antenna (with flagelliform setae on last antennomeres), the constricted neck, the long coronal suture and long multiarticulate urogomphi with the Dryptini (only the larva of *Drypta* Latreille is known). These character states can be regarded as synapomorphies and therefore both tribes are sistergroups. The larva of *Drypta* is distinguished from the Galeritini by the oval shape of head, smooth, slightly convex nasale, broad rounded ligula with only one pair of setae and one pair of pores, V-shape of frontal suture, not sloped, a pulvillus on both claws, and the different, simple chaetotaxy. The third instar larvae of *Drypta* show a plesiomorphic arrangement of nasale and adnasale setae (sensu Bousquet & Goulet 1984). Their head appendages and abdominal sclerites are not multisetose, large bristles on femur and ventral side of head capsule as well as the setal group gMX are lacking.

Galeritini and Dryptini are placed in one supertribe together with Zuphiini by Ball (1985) and Erwin (1991). Larvae of Zuphiini are practically unknown (see also Arndt 1993, van Emden 1942), therefore we do not know their exact character distribution.

Table 1. Different character states of third instar larvae of the genera *Galerita* and *Trichognathus*.

Character	*Galerita*	*Trichognathus*
Sides and neck of head	Head capsule widest at antennal base, angled neck gradually constricted	Head capsule widest in region of eyes; lateral sides of head subparallel, neck abrupt constricted (Fig. 1)
Ventral surface of head	With three very long bristles, two of them based on hooks	With three long bristles not based on hooks
Nasale	Nasale horns extremely long and protruded (Fig. 3)	Nasale horns short and stout (Fig. 2)
Galea	Long, of normal shape	Stout, finger-shaped (Fig. 4)
Maxillary palpomeres	Slender, of normal length	Elongate (Fig. 4)
Ligula	Very long	Short and indistinct
Anterior coxa	Dorsally with a row of large, bristle bearing processes (Fig. 6)	Without processes, dorsally only large bristles (Fig. 5)
Appendages of claws	Anterior claw with basal spine*	Both claws without appendages
Urogomphi	About as long as thorax + abdomen, with 30-40 articles	About as long as metathorax + abdomen, with 18-22 articles

* According to VAN EMDEN's (1942) generic description some species have spines on both claws.

Acknowledgements

We thank very much Prof. G.E. BALL (Edmonton) and Prof. D.L. PEARSON (Tempe, Arizona) for proof reading and valuable remarks.

Zusammenfassung

Die Larve der monotypischen neotropischen Gattung *Trichognathus* LATREILLE (Galeritini) wird beschrieben und mit der Larve von *Galerita* FABRICIUS verglichen. Beide Gattungen zeichnen sich durch ein vorspringendes hornförmiges Nasale, sehr lange geißelförmige Seten an den Antennomeren III und IV, lange Beine mit schlanken Gliedern, peitschenförmige Urogomphi und eine ähnliche, auffallende Chaetotaxie aus. *Trichognathus* unterscheidet sich im Larvenstadium von *Galerita* durch die parallelseitige Kopfkapsel, den abrupt eingeschnürten Nacken, das kürzere Nasale, die gedrungene Galea, schlankere Maxillarpalpen, einfache Klauen ohne Anhänge und die einfache Vorderhüfte. Galeritini und Dryptini bilden wahrscheinlich Schwestergruppen. Als larvale Synapomorphien beider Taxa werden die langen Antennen mit geißelförmigen Seten, der verengte Nacken, die lange Coronalnaht und die Form der Urogomphi diskutiert.

References

ARNDT, E. 1991: Carabidae. In: KLAUSNITZER, B. (ed.), Die Larven der Käfer Mitteleuropas, Bd. 1. – Goecke & Evers, Krefeld, 45-141.

ARNDT, E. 1993: Phylogenetische Untersuchung der Carabidae (Insecta, Coleoptera) unter besonderer Berücksichtigung larvalmorphologischer Merkmale. – Stuttgarter Beiträge zur Naturkunde, Serie A, **488**, 1-56.

BALL, G.E. 1985: Reconstructed phylogeny and geographical history of genera of the tribe Galeritini (Coleoptera: Carabidae). In: BALL, G.E. (ed.), Taxonomy, Phylogeny and Zoogeography of Beetles and Ants. – Dr. W. Junk Publishers, Dordrecht, 276-321.

BOUSQUET, Y., GOULET, H. 1984: Notation of primary setae and pores on larvae of Carabidae (Coleoptera: Adephaga). – Canadian Journal of Zoology **62**, 573-588.

CANDÈZE, M.E. 1861: Histoire des metamorphoses de quelques coléoptères exotiques. – Mémoires Societé Royal Science Liège **16**, 325-410.

Costa, C., Vanin, S.A., Casari-Chen, S.A. 1988: Larvas de Coleoptera do Brasil. – Museu de Zoologia, Universidade São Paulo, 447pp.

Erwin, T.L. 1991: The ground-beetles of Central America (Carabidae), Part II: Notiophilini, Loricerini, and Carabini. – Smithsonian Contributions to Zoology **501**, 1-30.

Emden, F.I. van 1942: A key to the genera of larval Carabidae (Col.). – Transactions of the Royal entomological Society, London **92**, 1-99.

Kirk, V.M. 1980: Identification of the Larva of *Galerita janus*, a ground beetle found in South Dakota Croplands (Coleoptera: Carabidae). – The Coleopterists Bulletin **34**, 367-368.

Reichardt, H. 1967: A monographic revision of the American Galeritini (Coleoptera, Carabidae). – Arquivos de Zoologia **15**, 1-176.

– – 1971: Notes on the bombarding behavior of three Carabid beetles (Coleoptera, Carabidae). – Revista Brasileira de Entomologia **15**, 31-34.

Sallé, M. 1849: Coléoptères nouveaux de l'Amerique. – Annales de la Societé Entomologique de France **7**, 297-303.

Schaupp, F.G. 1882: Remarks on some coleopterous pupae. – Bulletin of the Brooklyn Entomological Society **5**, 18.

Thompson, R.G. 1979: Larvae of North American Carabidae with a key to the tribes. In: Erwin, T.L., Ball, G.E., Whitehead, D.R., Halpern, R.L. (eds.), Carabid beetles: Their evolution, natural history, and classification. – Dr. W. Junk Publishers, The Hague, 209-291.

Authors' address:

Dr. Erik Arndt
Anhalt University of Applied Sciences
LOEL
Strenzfelder Allee 28
D-06406 Bernburg
Germany

e-mail: earndt@serviwi.wi.fh-anhalt.de

Dipl.-Biol. Ulf Drechsel
Gral. Aquino 694, 1536
Ascunión
Paraguay